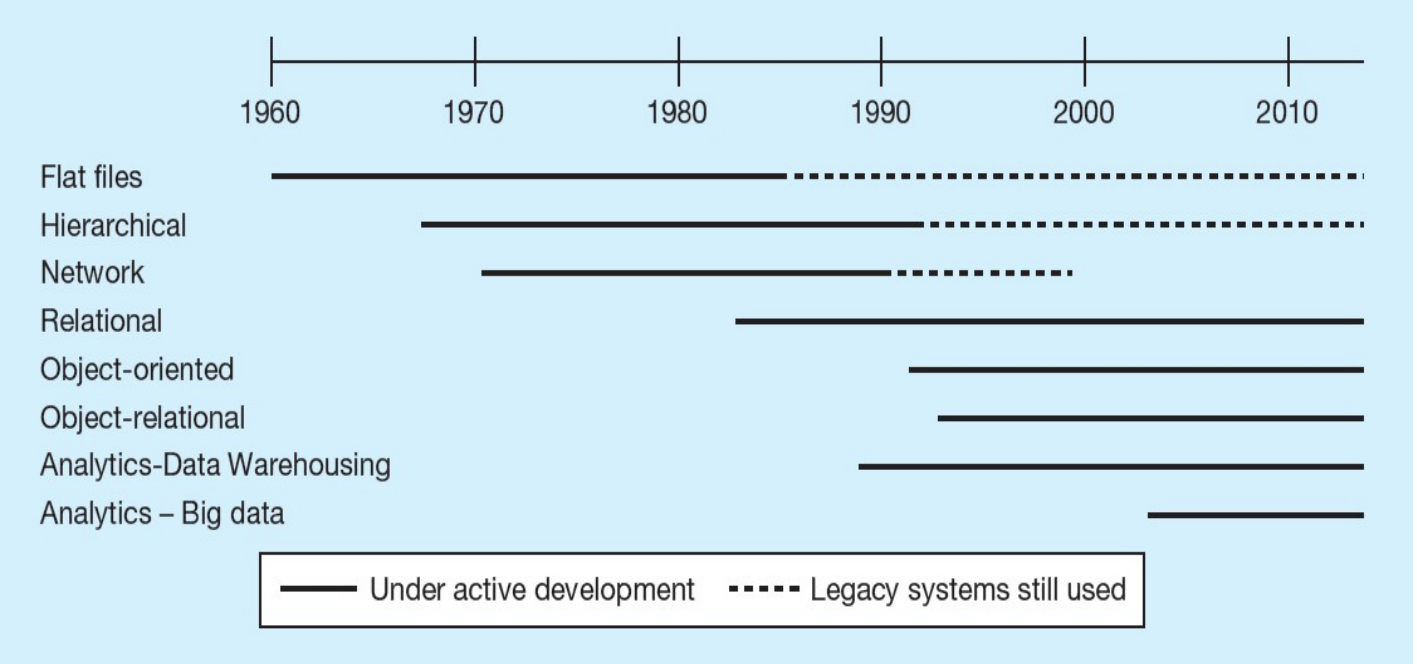

Chapter 1’ced
The Database Development Process

Evolution of Database Systems

- Driven by four main objectives:
  - Need for program-data independence in order to reduce maintenance
  - Desire to manage more complex data types and structures
  - Ease of data access for less technical personnel
  - Need for more powerful decision support platforms

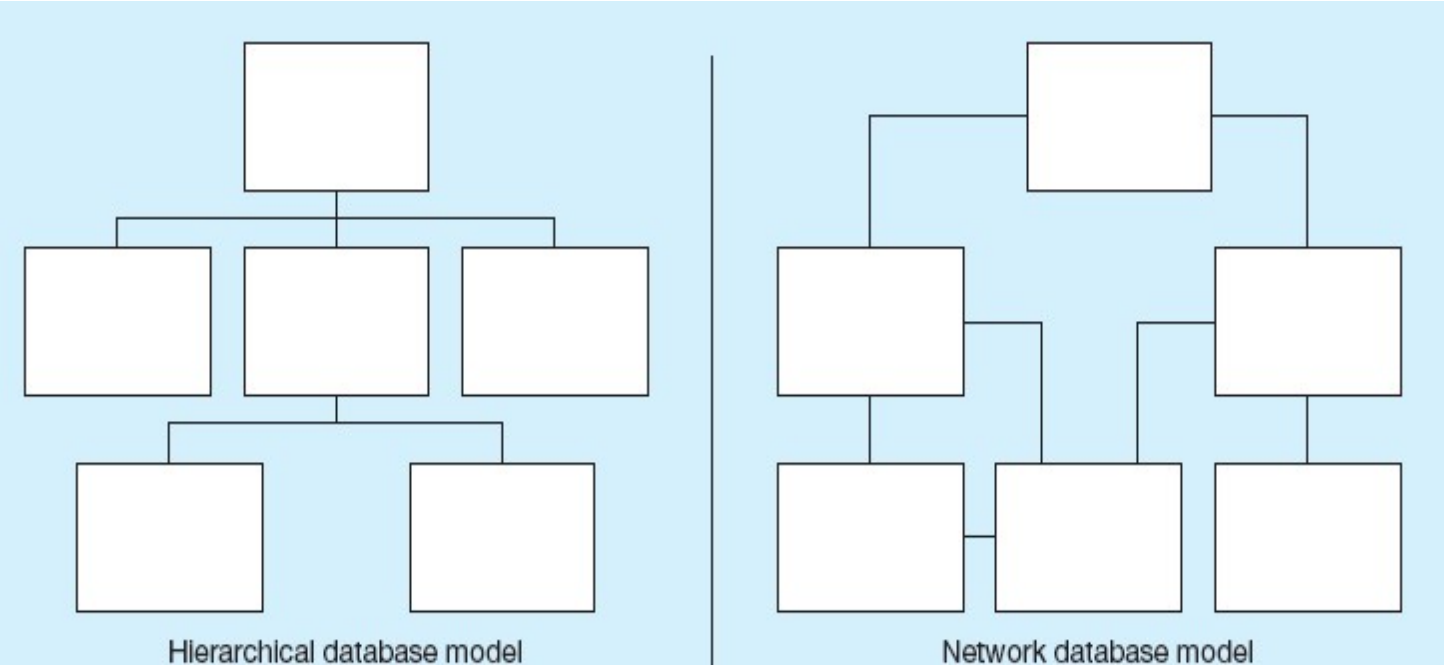
The Range of Database Technologies: Past and Present

(a) Evolution of database technologies



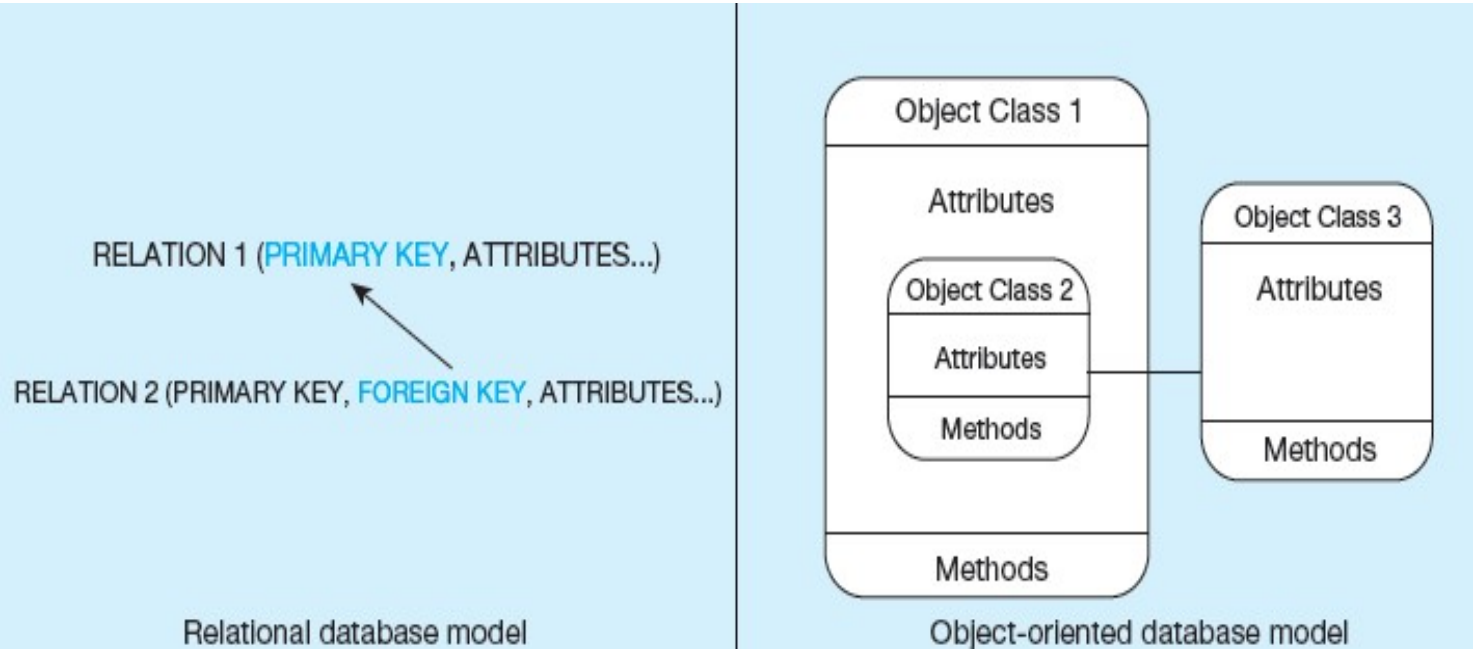
The Range of Database Technologies: Past and Present

(b) Database architectures



The Range of Database Technologies: Past and Present

(b) Database architectures



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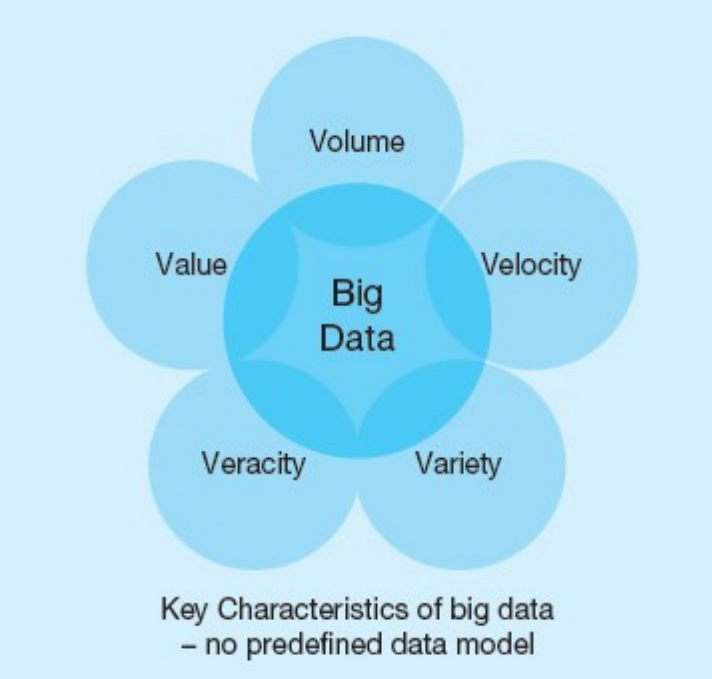
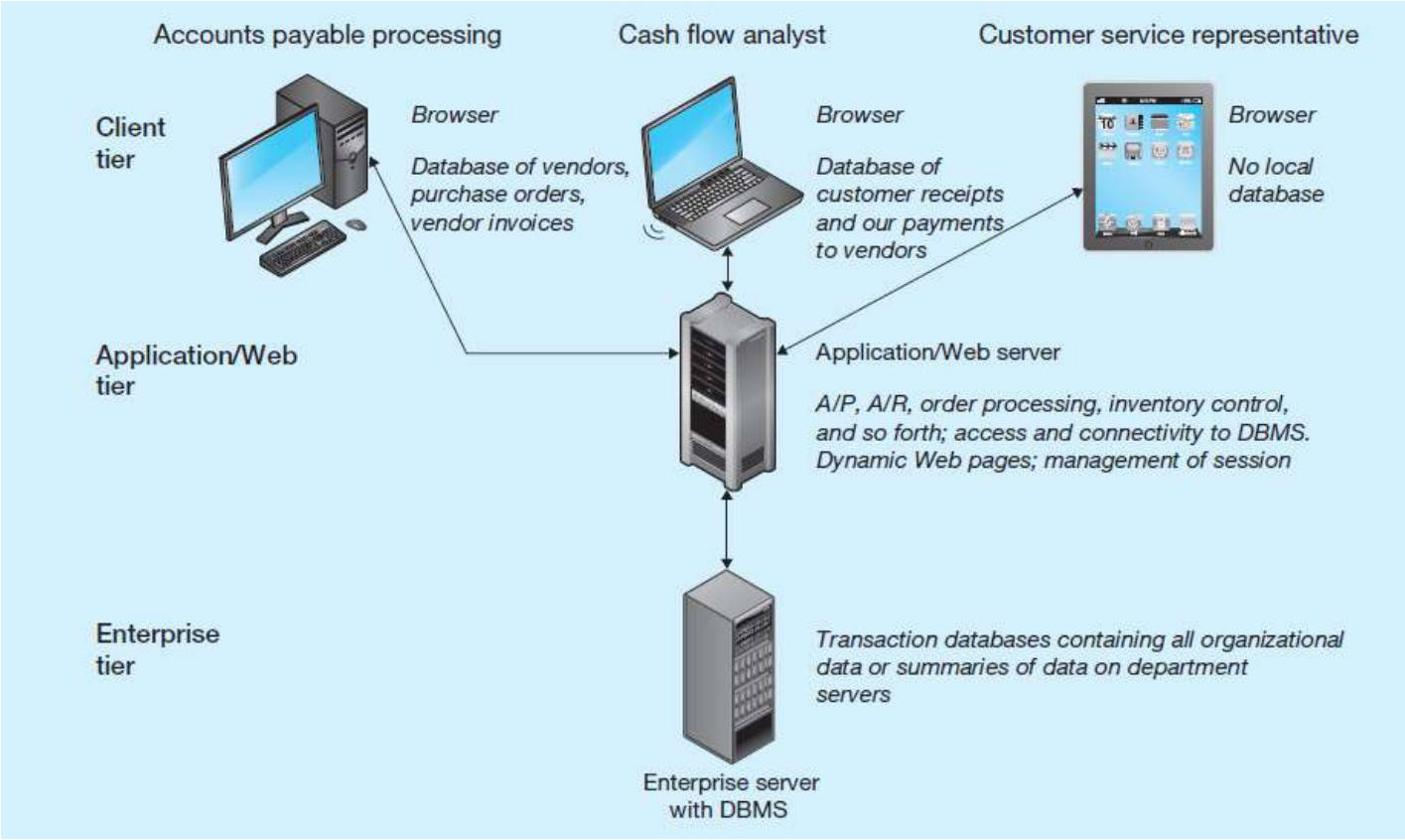
(b) Database architectures



Key Characteristics of big data
– no predefined data model

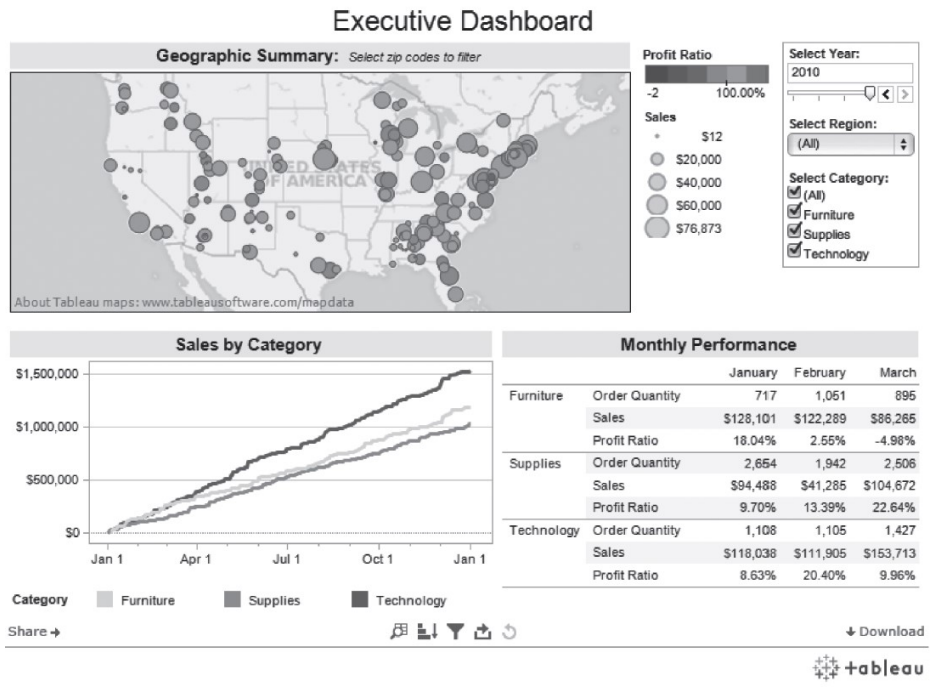
Multi-Tiered Client/Server Database Architecture



Types of Enterprise Applications

- Enterprise Systems (typically involve relational databases)
  - Backbone of an organization
  - Enterprise resource planning (ERP)
  - Customer relationship management
  - Supply chain management
  - Human resource management and payroll
- Data Warehouses (typically involve relational databases)
  - Integrates data from multiple data sources
  - Maintain historical data
  - Help identify patterns and trends
- Data Lakes (often don’t involve relational databases)
  - Large integrated repository for internal and external data that does not follow a predefined schema

An Example of an Executive Dashboard



(http://public.tableausoftware.com/profile/mirandali#!/vizhome/Executive-Dashboard_7/ExecutiveDashboard)
Courtesy Tableau Software

Building Information Systems

Information Systems Architecture (ISA)

- Conceptual blueprint for organization's desired information systems structure
- Consists of:
  - Data (e.g., Enterprise Data Model – simplified ER Diagram)
  - Processes – data flow diagrams, process decomposition, etc.
  - Data Network – topology diagram
  - People – people management using project management tools (Gantt charts, etc.)
  - Events and points in time (when processes are performed)
  - Reasons for events and rules (e.g., decision tables)

Information Systems Planning

- Purpose: align information technology with organization's business strategies
- Three steps:
  1. Identify strategic planning factors
  2. Identify corporate planning objects
  3. Develop enterprise model

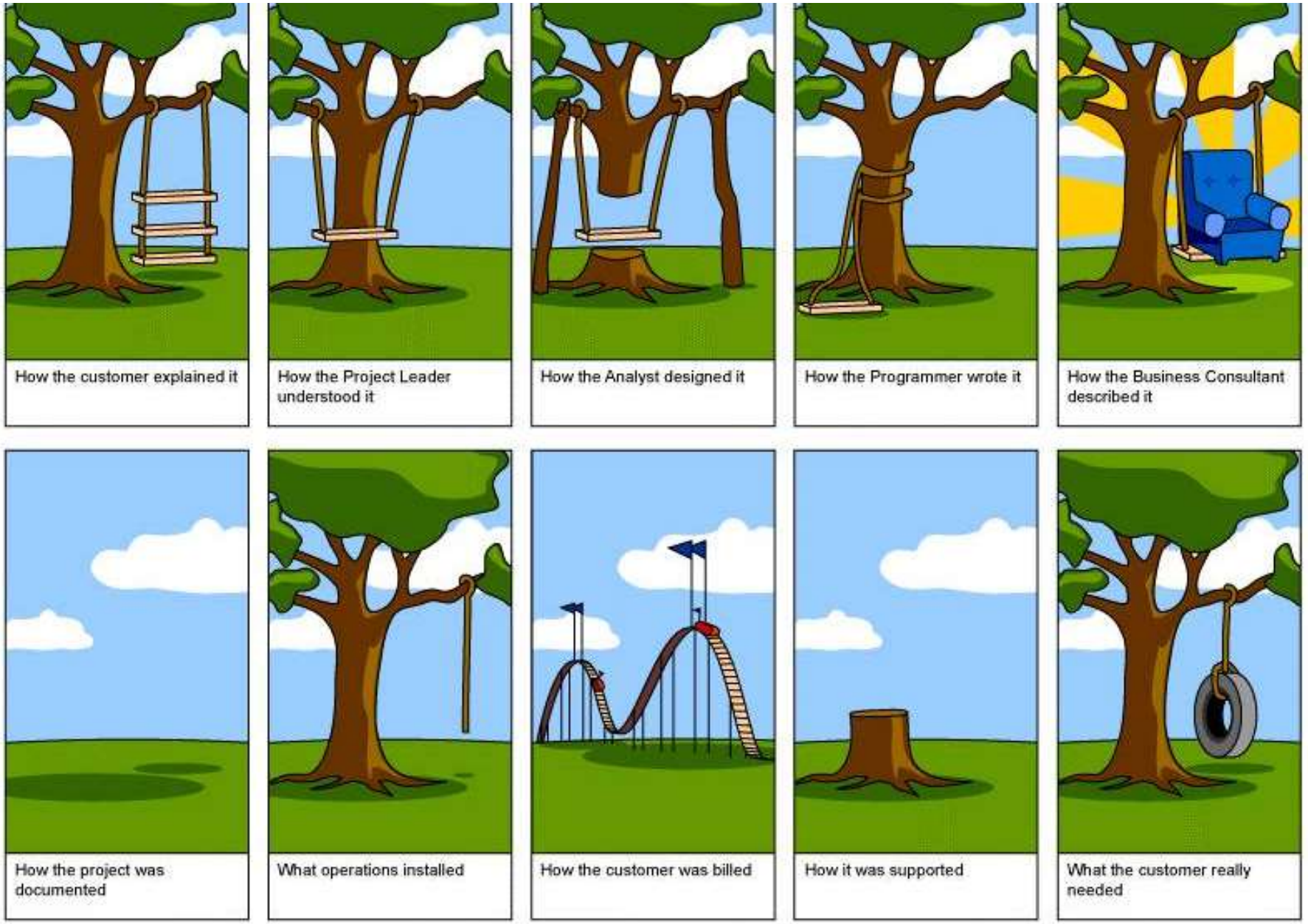
Identify Strategic Planning Factors

- Organization goals – what we hope to accomplish
- Critical success factors – what MUST work in order for us to survive
- Problem areas – weaknesses we now have

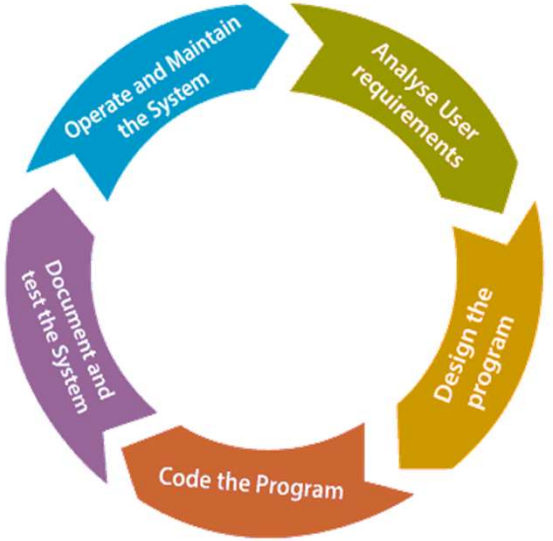
- Parkinson's law
- Brooks's law

Identify Corporate Planning Objects

- Organizational units – departments
- Organizational locations
- Business functions – groups of business processes
- Entity types – the things we are trying to model for the database
- Information systems – application programs

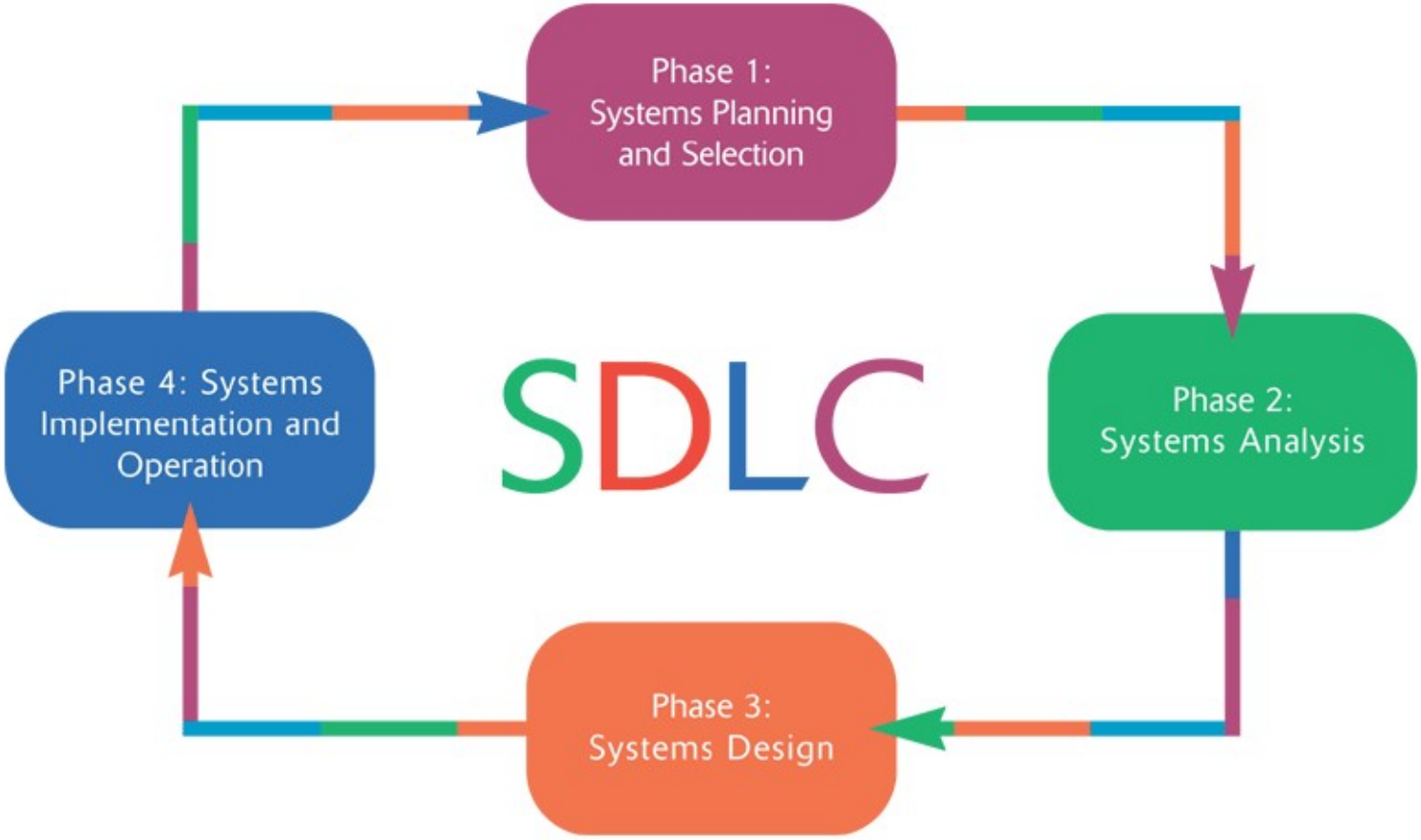

How the customer explained it
How the Project Leader understood it
How the Analyst designed it
How the Programmer wrote it
How the Business Consultant described it
How the project was documented
What operations installed
How the customer was billed
How it was supported
What the customer really needed

Approaches to Database and IS Development

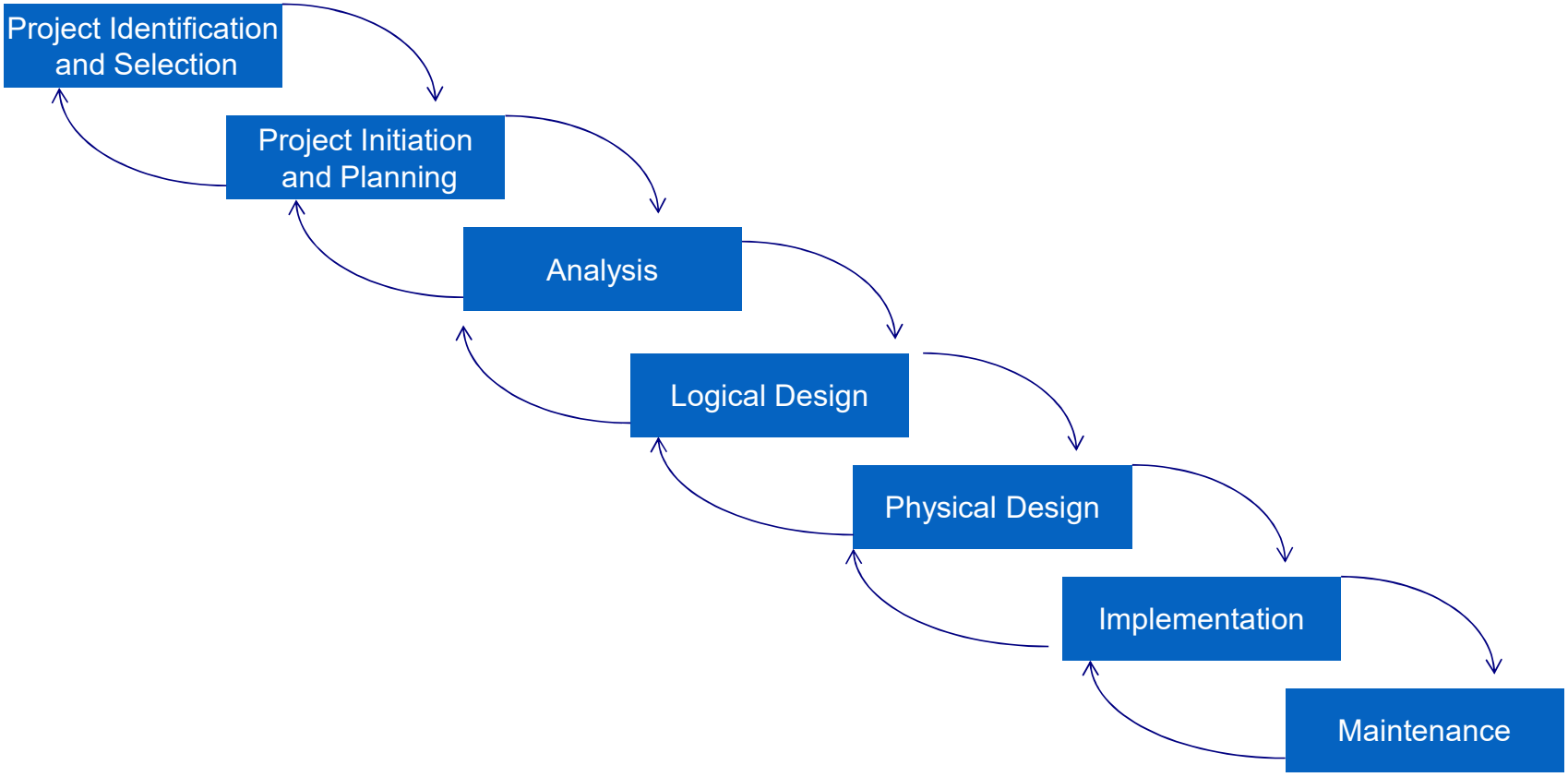


- **SDLC**
  - **System Development Life Cycle**
  - **Detailed, well-planned development process**
  - **Time-consuming, but comprehensive**
  - **Long development cycle**
- Prototyping
  - Rapid application development (RAD)
  - Cursory attempt at conceptual data modeling.
  - Define database during development of initial prototype
  - Repeat implementation and maintenance activities with new prototype versions
- Agile development
  - Requirement gathering and analysis
  - Design the requirements
  - Construct/iterate
  - Deploy
  - Test
  - Feedback

Systems Development Life Cycle



Systems Development Life Cycle



Systems Development Life Cycle (cont.)

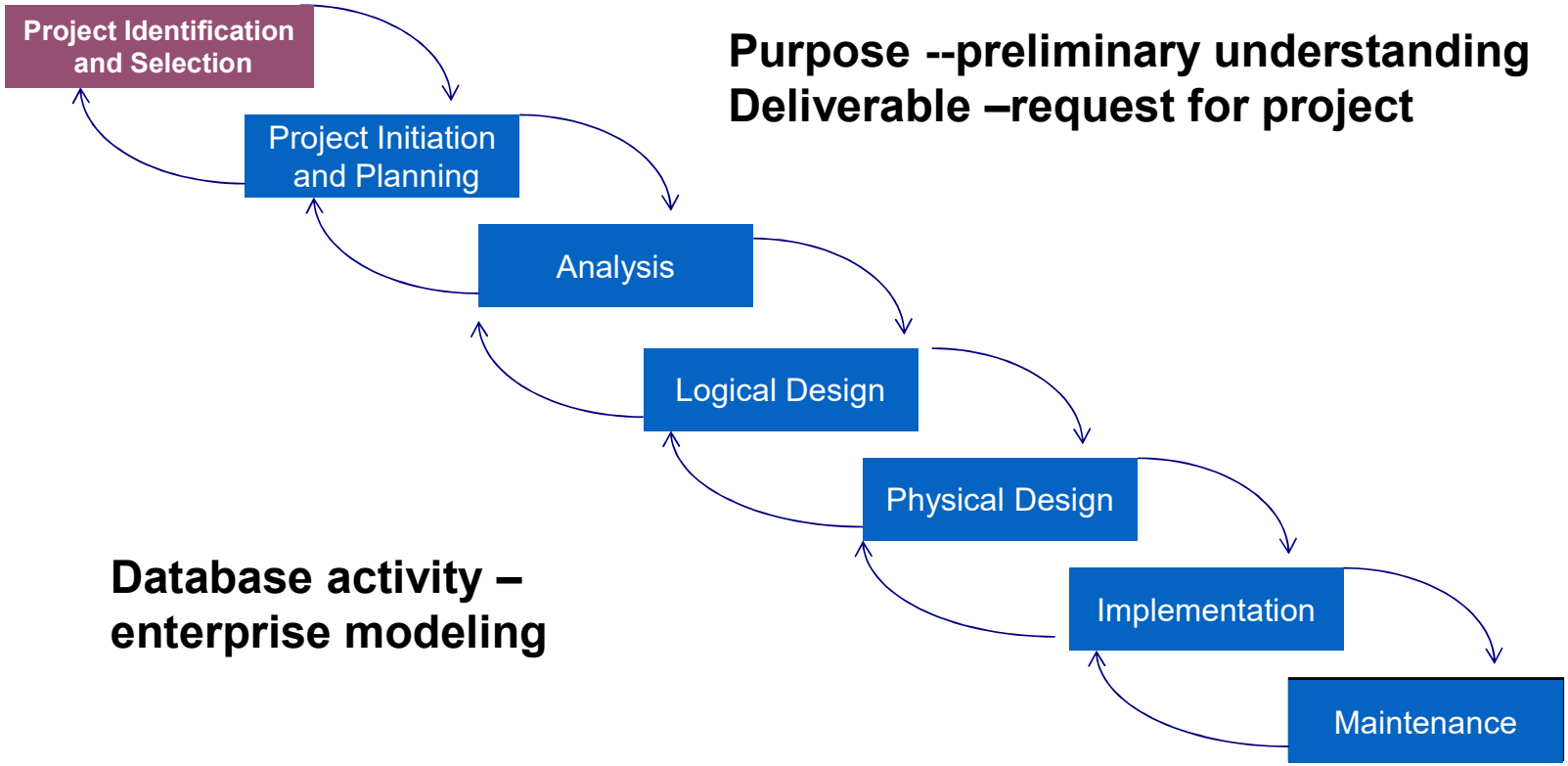
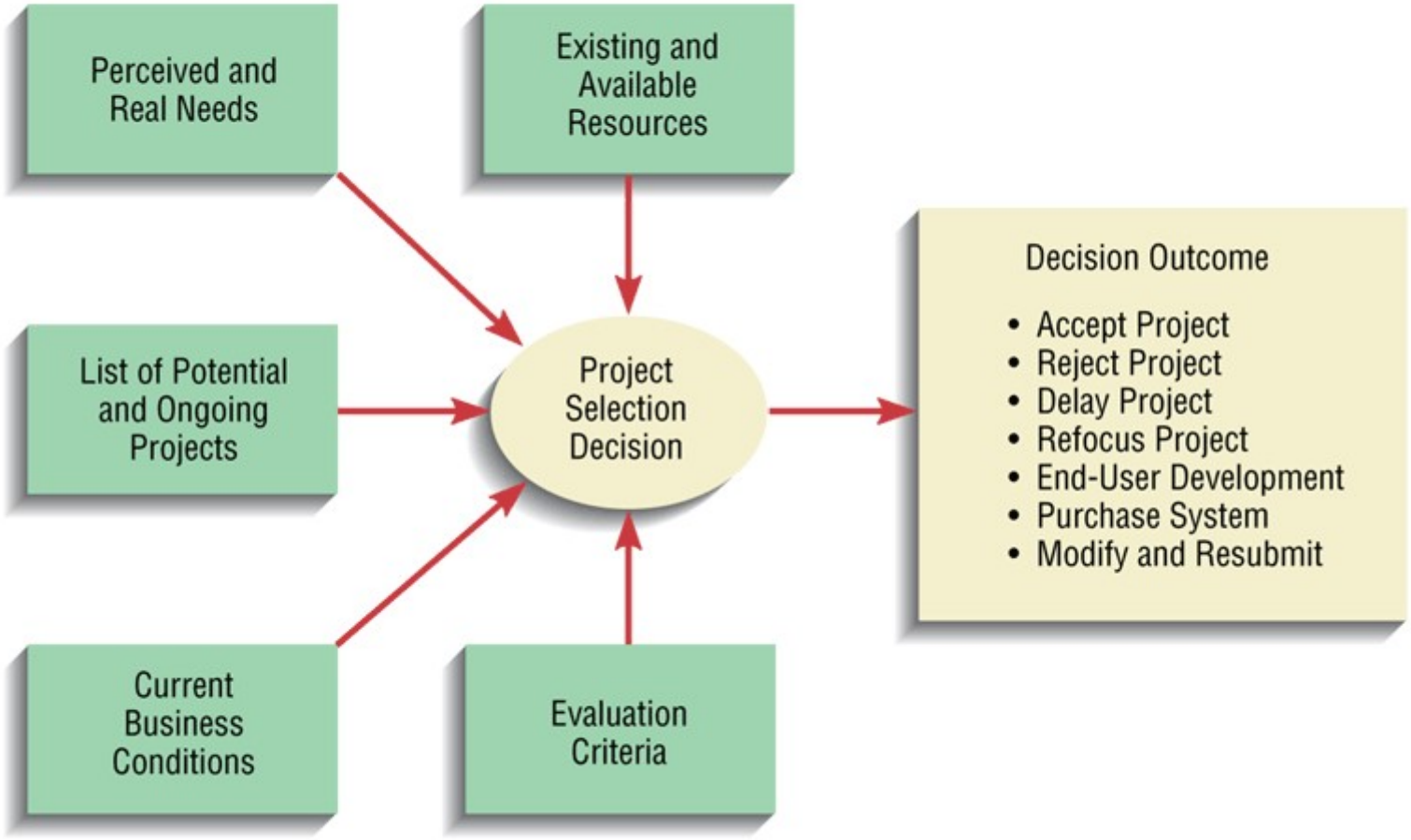
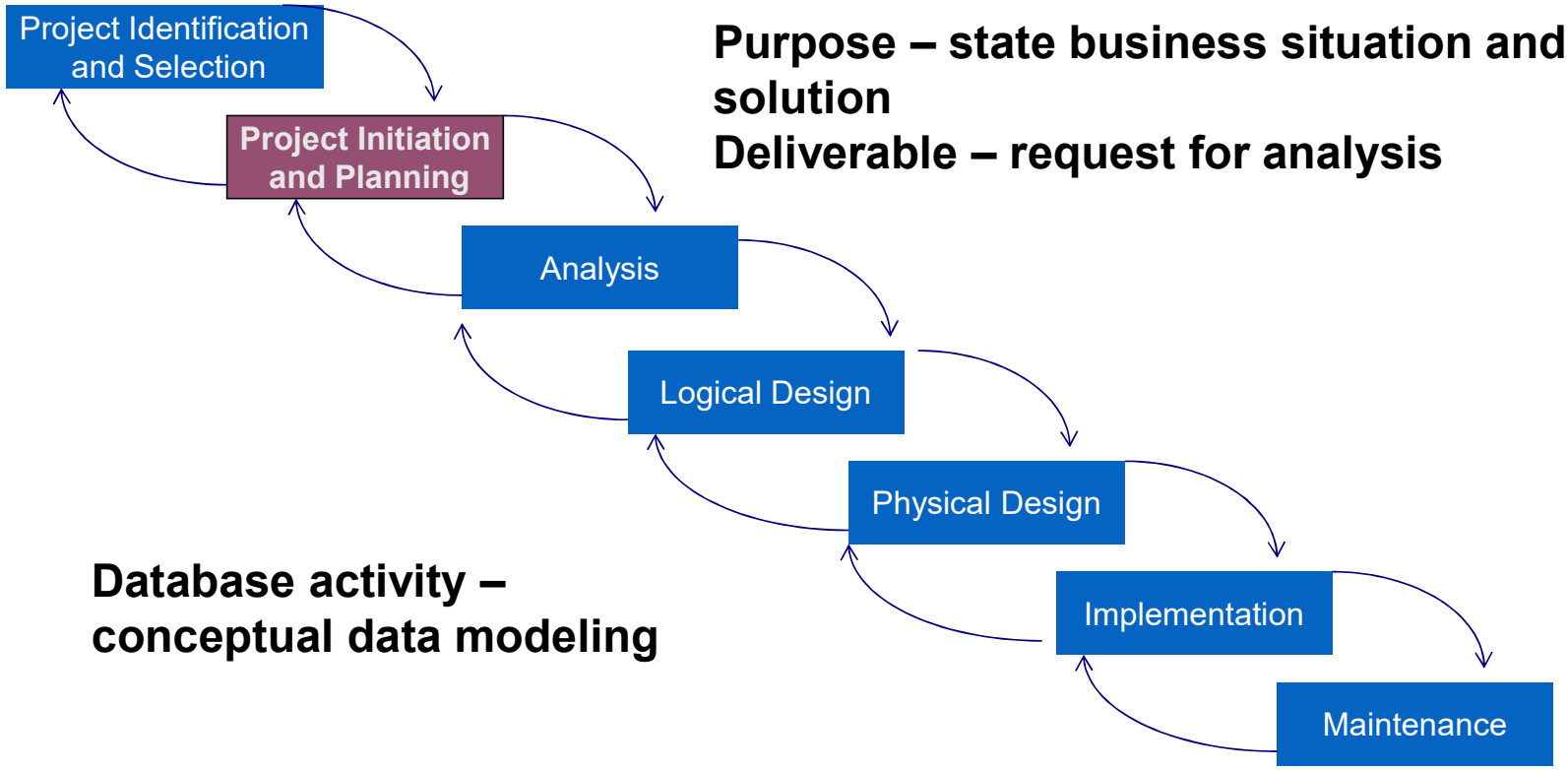


Figure 3.3 Numerous factors must be considered when selecting a project.



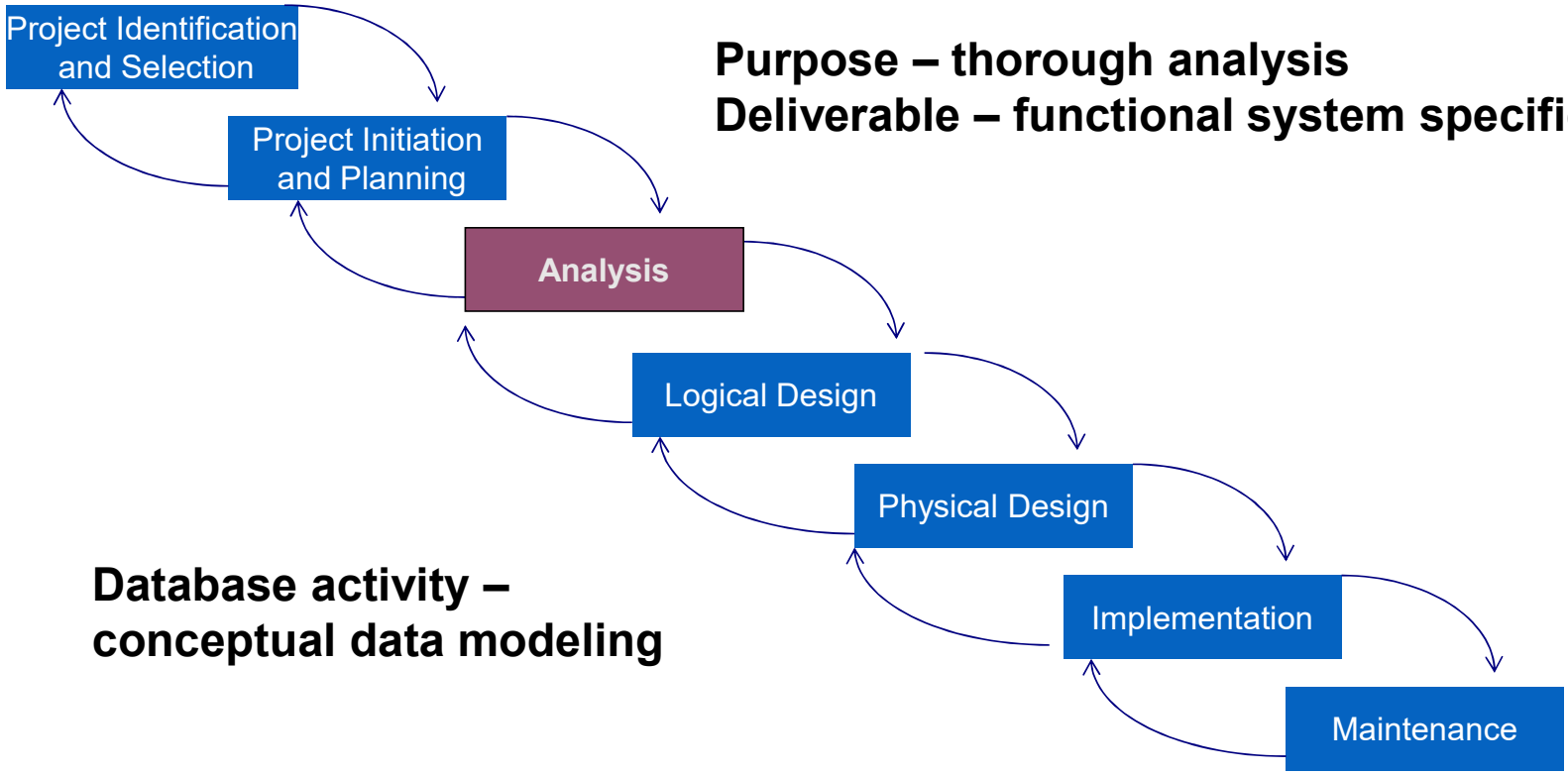
Systems Development Life Cycle (cont.)



Purpose – state business situation and solution
Deliverable – request for analysis

Database activity – conceptual data modeling

Systems Development Life Cycle (cont.)



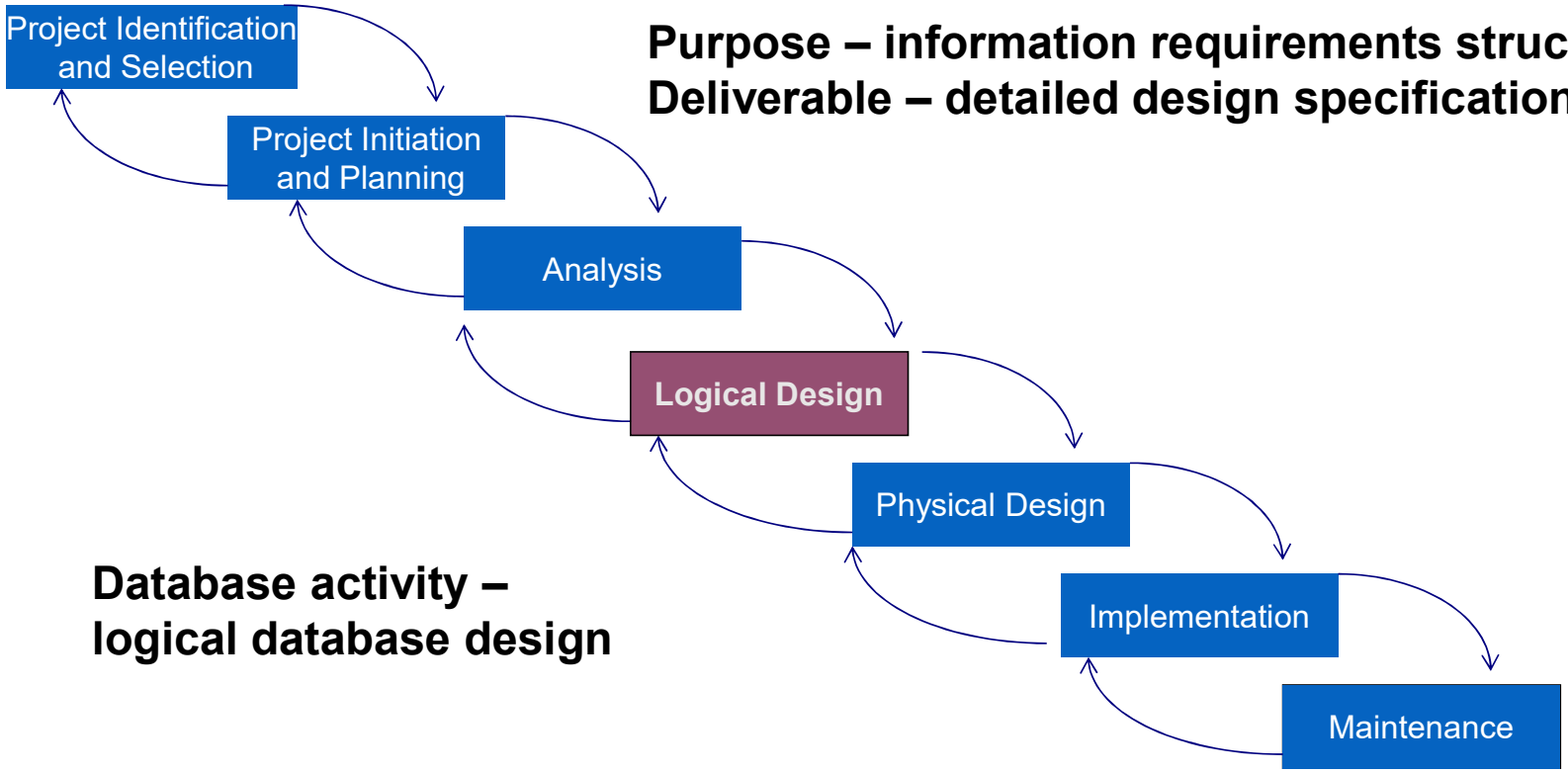
Purpose – thorough analysis
Deliverable – functional system specifications

Database activity – conceptual data modeling

Analysis Stage

- **Study of current procedures and information systems**
  - **Determine requirements**
  - **Generate alternative designs**
    - Considers one or more alternate designs and analyzes their advantages and disadvantages
  - **Compare alternatives**
  - **Recommend best alternative**

Systems Development Life Cycle (cont.)



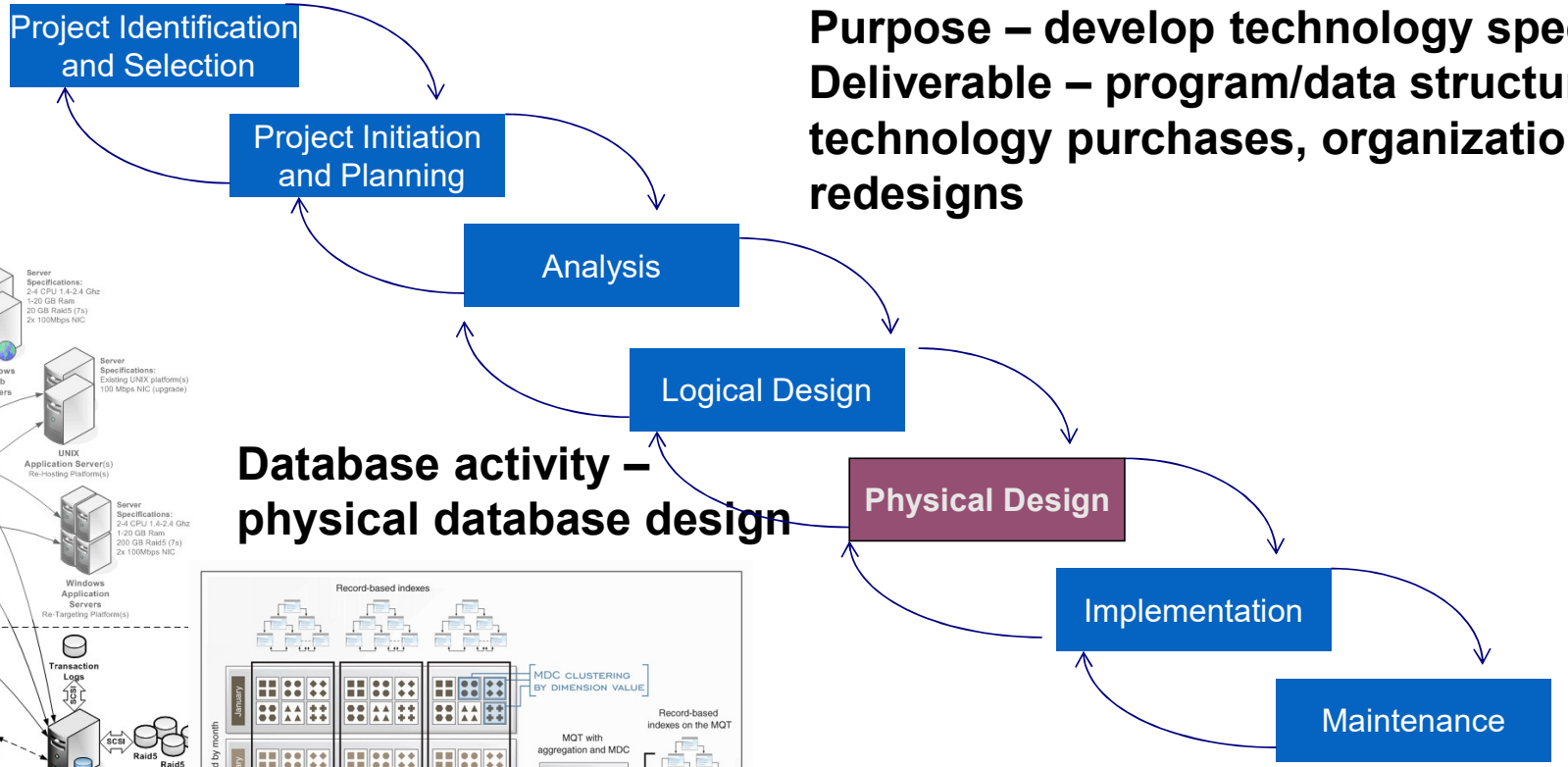
Purpose – information requirements structure
Deliverable – detailed design specifications

Database activity – logical database design

Design Stage

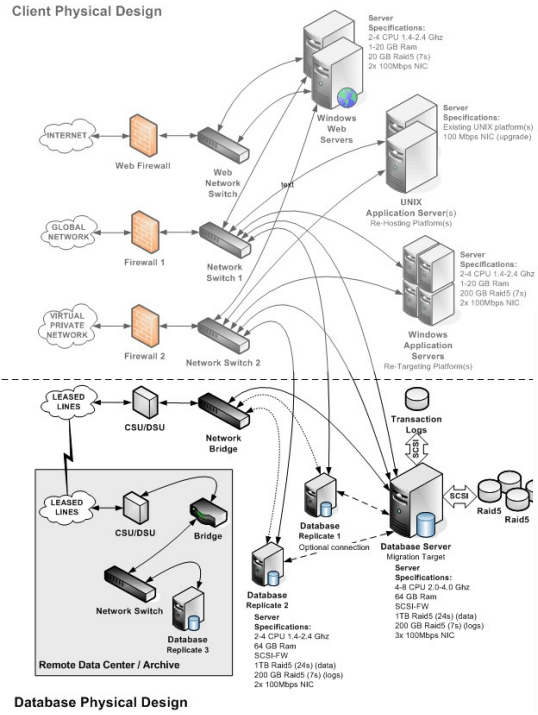
- Refers to the creation of detailed specifications for the proposed system
- Logical Design
- Physical Design

Systems Development Life Cycle (cont.)

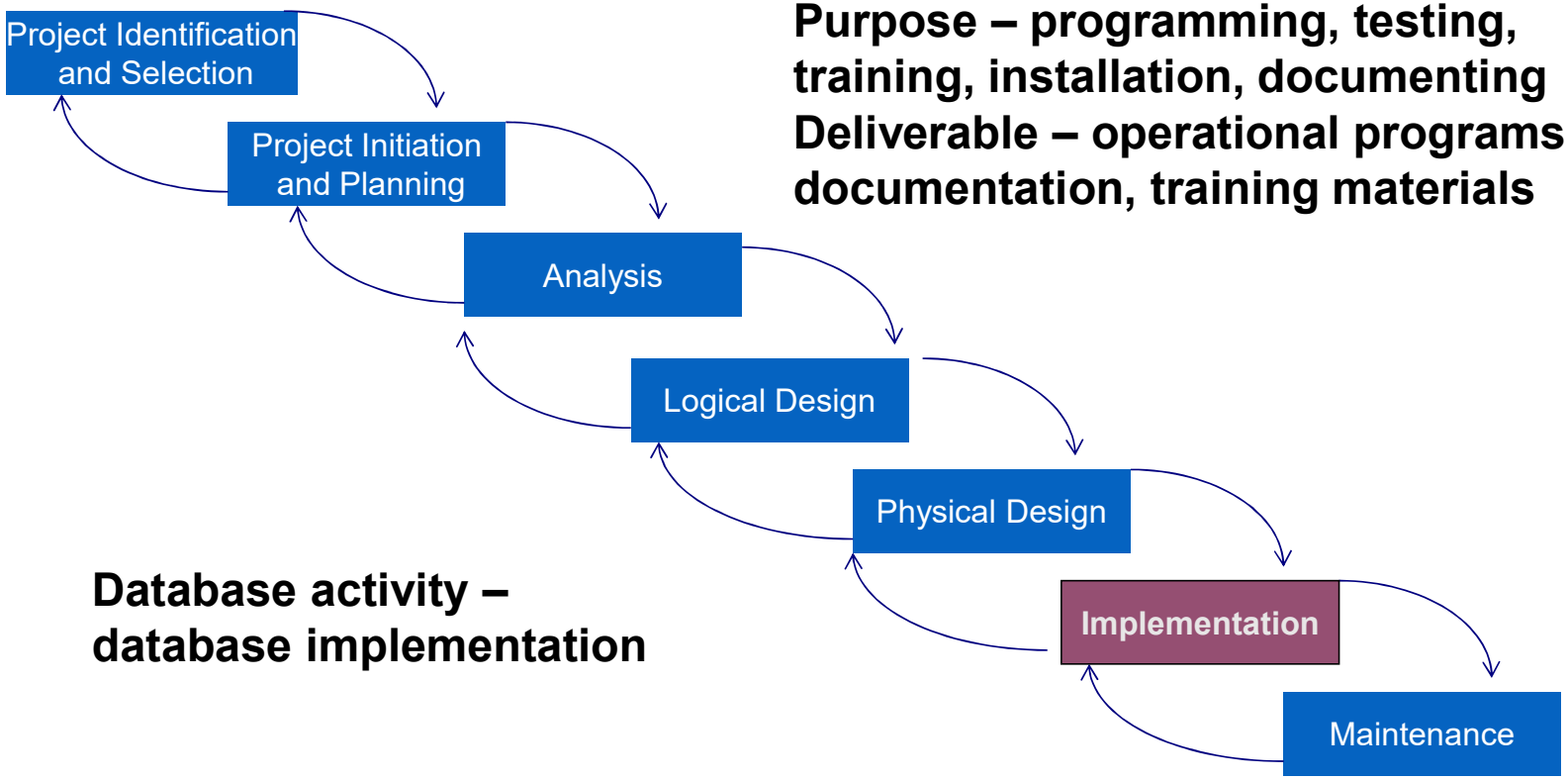


Purpose – develop technology specs
Deliverable – program/data structures, technology purchases, organization redesigns

Database activity – physical database design



Systems Development Life Cycle (cont.)



Purpose – programming, testing, training, installation, documenting
Deliverable – operational programs, documentation, training materials

Database activity – database implementation

System Implementation

- Most expensive and time-consuming phase of SDLC
- Organizational change process
  - not always successful
- Purpose
  - To convert final physical system specifications into working and reliable software
  - To document work that has been done
  - To provide help for current and future users

System Implementation

- Six major activities
  - Coding, Physical design specifications are turned into working computer code
  - Testing. It can be performed in parallel with coding
  - Installation, Process during which the current system is replaced by the new system
  - Documentation
  - Training
  - Support

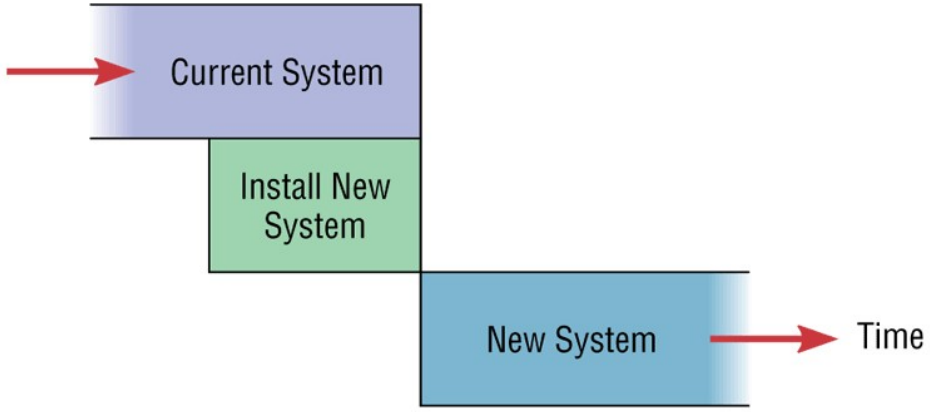
Installation

- The organizational process of changing over from the current information system to a new one
- Four approaches
  - Direct Installation
  - Parallel Installation
  - Single location installation
  - Phased Installation

Installation

- Direct Installation
  - Changing over from the old information system to a new one by turning off the old system when the new one is turned on
  - Rarely used due to risk (inexpensive)

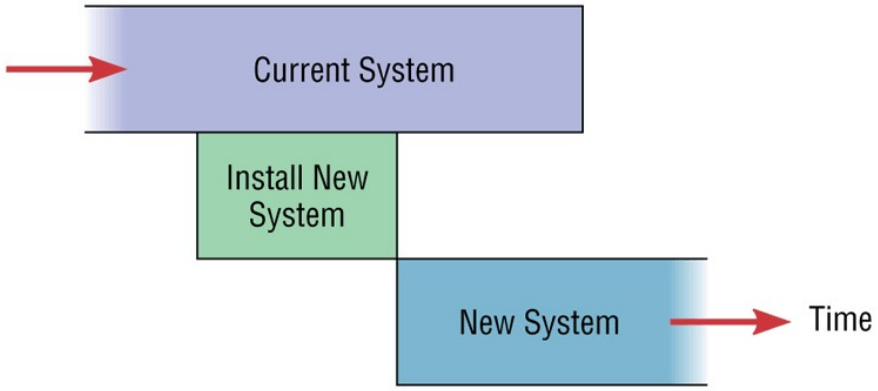
Figure 10.5a Comparison of Installation Strategies — Direct Installation



Installation

- Parallel Installation
  - Running the old information system and the new one at the same time until management decides the old system can be turned off
  - Old and new running at the same time
  - Risk-less (expensive)

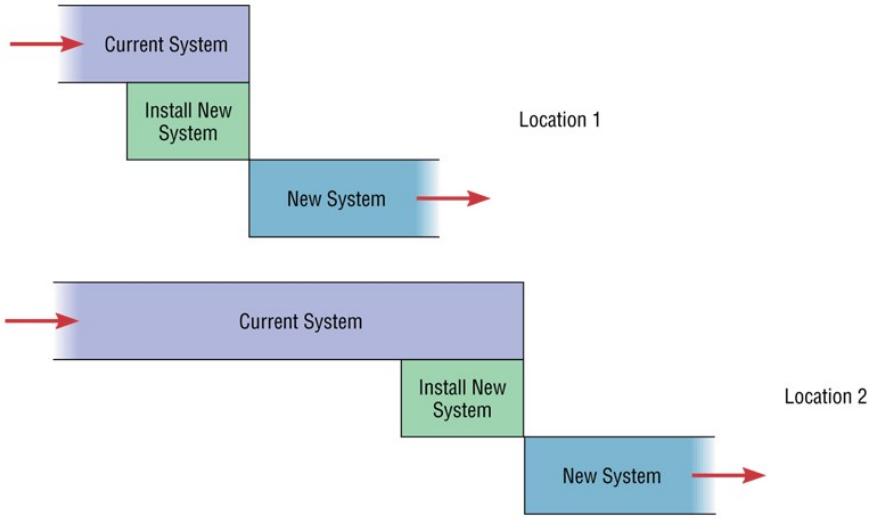
Figure 10.5b Comparison of Installation Strategies — Parallel Installation



Installation

- Single location installation
  - Test site gets full system
  - Trying out an information system at one site and using the experience to decide if and how the new system should be deployed throughout the organization

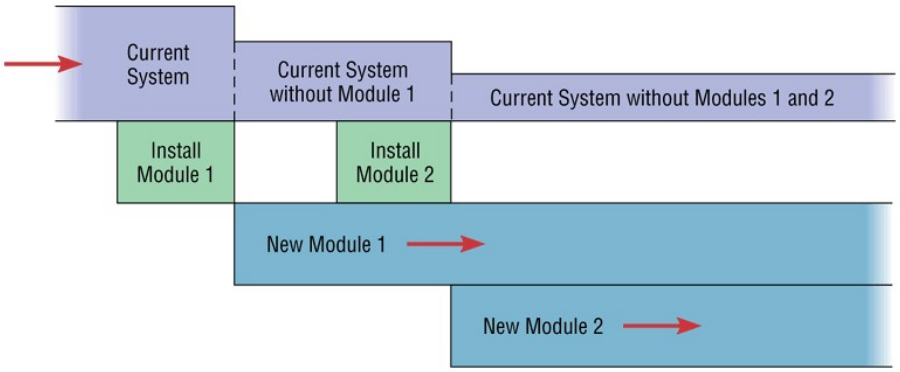
Figure 10.5c Comparison of Installation Strategies — Single Location Installation (with Direct Installation at Each Location)



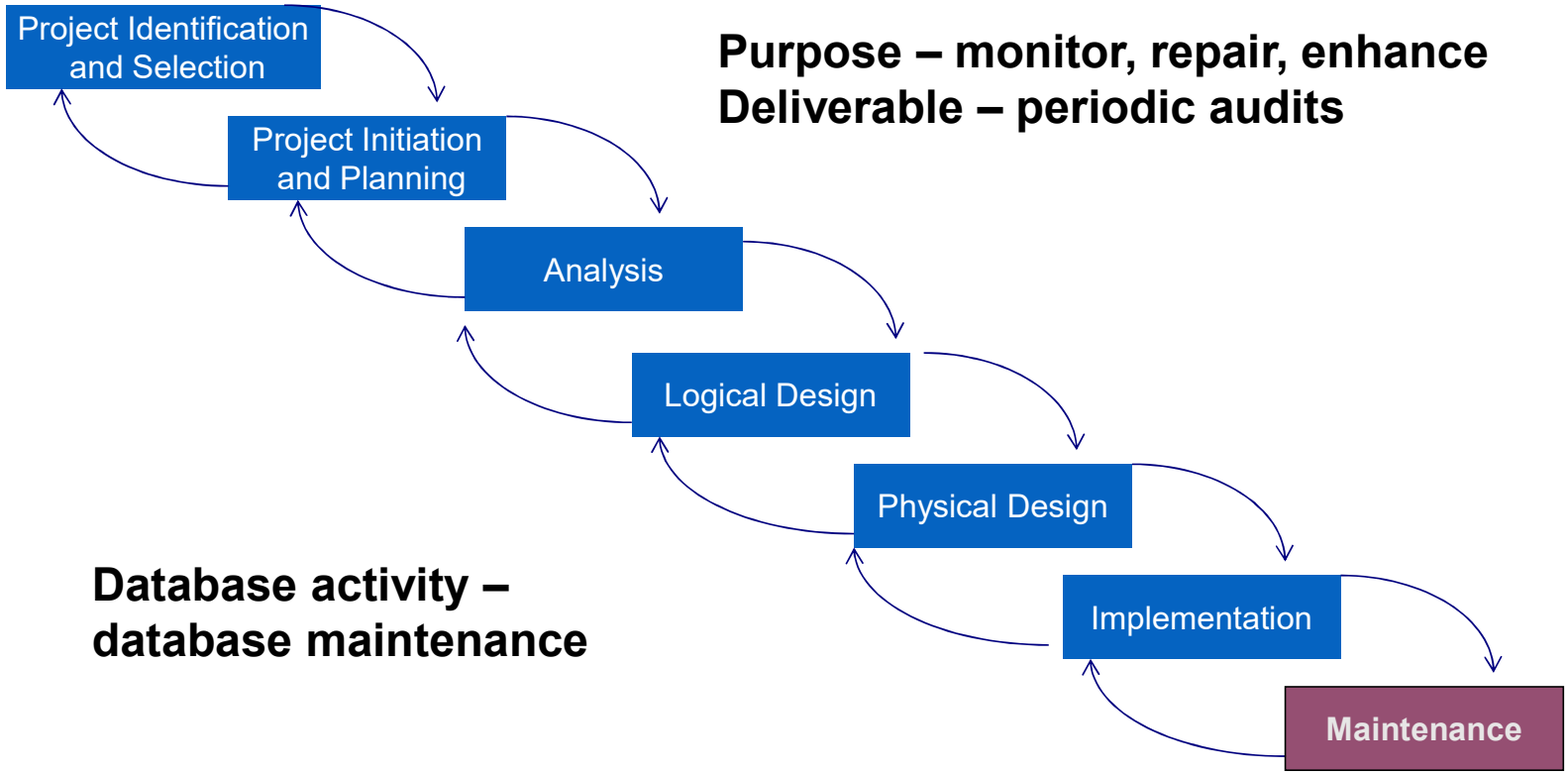
Installation

- Phased Installation
  - One component at a time at one or all sites
  - Changing from the old information system to the new one incrementally, starting with one or a few functional components and then gradually extending the installation to cover the whole new system

Figure 10.5d Comparison of Installation Strategies — Phased Installation



Systems Development Life Cycle (cont.)



Purpose – monitor, repair, enhance
Deliverable – periodic audits

Database activity – database maintenance

Joint Application Design (JAD)

- Brings together key users, managers and systems analysts
- Purpose: collect system requirements simultaneously from key people
- Conducted off-site
- Reduces length of analysis and design phases
- Reduces cost of systems development by correctly defining and prioritizing system requirements
- Increase user satisfaction with system

Disadvantages of JAD

- Large number of participants makes meeting difficult to manage
- Small number of participants may dominate
- Personal styles may lower participation
- Political issues may influence participation
- Expensive

Business Process Reengineering (BPR)

- Search for and implementation of radical change in business processes to achieve breakthrough improvements in products and services

Business Process Reengineering (BPR)

- Goals
  - Reorganize complete flow of data in major sections of an organization
  - Eliminate unnecessary steps
  - Combine steps
  - Become more responsive to future change
  - Reduce workforce needed
  - build customer relationships
  - increase efficiency and profits

BPR

- Michael Dell:
  - "If you have a good strategy with sound economics, the real challenge is to get people excited about what you're doing. A lot of businesses get off track because they don't communicate an excitement about being part of a winning team that can achieve big goals. If a company can't motivate its people and it doesn't have a clear compass, it will drift."

Prototyping

- Quickly converts requirements to working version of system, Building a scaled-down working version of the system
- Once the user sees requirements converted to system, will ask for modifications or will generate additional requests
- **Prototyping Goals:**
  - Shortened development time
    - system will more closely meet organization's requirements
  - Increased user participation
    - increased user satisfaction
  - Develop concrete specifications for the ultimate system…not to build it

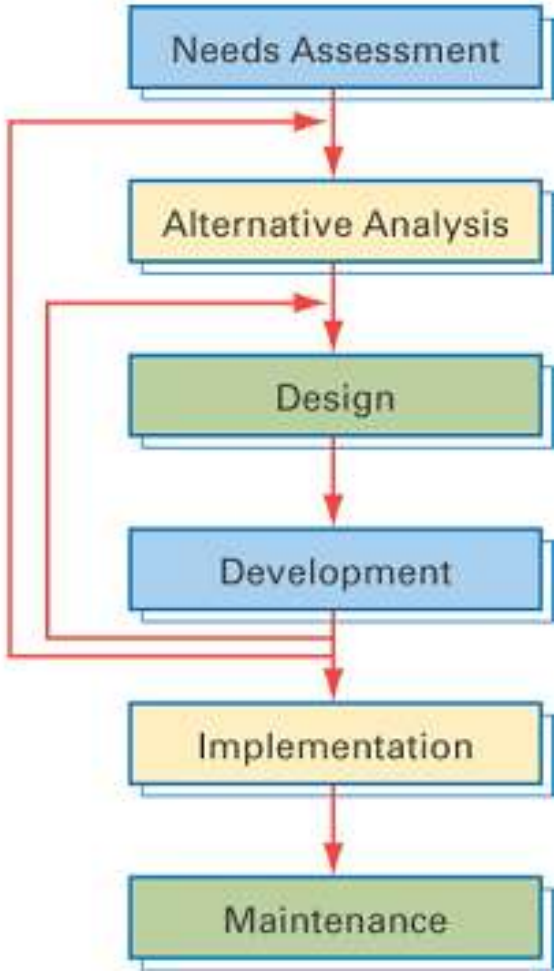
Prototyping

- Most useful when:
  - User requests are not clear
  - Few users are involved in the system
  - Designs are complex and require concrete form
  - Tools are readily available to build prototype

Prototyping

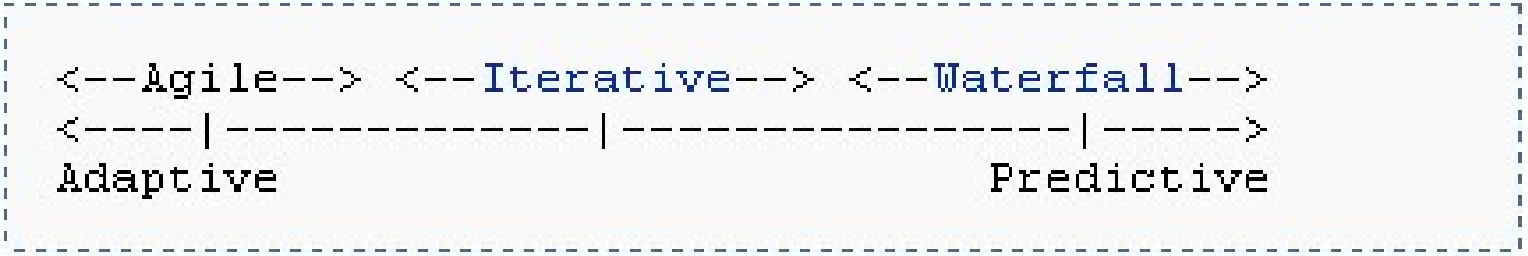
- Drawbacks
  - Difficult to adapt to more general user audience
  - Sharing data with other systems is often not considered. Prototypes often built as stand-alone systems
  - Systems Development Life Cycle (SDLC) checks are often bypassed

Prototyping



Agile vs. Waterfall

- Predictive methods: plan future in detail
  - Waterfall model
- Adaptive methods: Adapting quickly to changing realities
  - Agile method



Agile approach

- Short, time-boxed sprints (2-4 weeks each).
- Continuous testing
- Frequent releases
- Adjustments based on feedback

- <10 team members (scrum master, developers, product owner)

Agile development

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Agile development